Energy Benchmarking: Does Your School Get a Passing Grade?

The Problem

One of the best ways to determine whether a school is using energy efficiently is to compare its performance to that of similar buildings—a process known as benchmarking. However, school districts rarely have the time, the data, or the expertise to do that kind of analysis.

The Solution

Analyzing energy consumption information from 39 elementary schools, 5 middle schools, and 5 high schools, researchers have developed a system for presenting energy-use data to facility managers, enabling them to make their own evaluations. This easy benchmarking process created through PIER research can be applied to any school district facility. Researchers from the Massachusetts Institute of Technology created the system in cooperation with the West Contra Costa Unified School District (WCCUSD) and Pacific Gas and Electric Co. (PG&E).

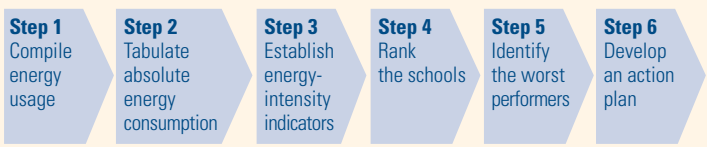
Features and Benefits

The new benchmarking system helps building operators and owners determine how well each building in the school district is performing. It also highlights the worst and best energy users, revealing which of the schools would reap the greatest energy savings from implementing energy conservation measures. If another school wishes to benchmark energy consumption, it could follow the same basic steps researchers used in creating the benchmarking process for the WCCUSD (**Figure 1**).

1. Gather and compile usage data for all fuels, including electricity, natural gas, fuel oil, and steam. If that information isn't readily available, work with the local utility to obtain it. For example, PG&E helped the WCCUSD develop spreadsheets based on the utility's data.

Figure 1: The benchmarking process

The process begins with data-gathering and culminates in a prioritized plan for implementing energy-saving measures.



Although annual energy bills can be used as general indicators of energy performance, analyzing daily consumption patterns is better for identifying problems in systems and in different facilities. Adding meters that can record energy usage in smaller intervals, such as daily intervals, can provide more-accurate benchmarking information.

2. Tabulate absolute energy consumption in terms of site energy use per year, broken down by electricity and natural gas. List total consumption, cost, and peak demand.

3. Establish energy intensity indicators in terms of energy use per unit area and energy use per student. Determine site energy consumption and cost, site energy and cost per student, site energy intensity and cost per unit floor area, energy per student-hour of operation, and energy intensity per hour of operation. School statistics regarding student population and density, school schedules, and physical building features, such as construction areas and equipment, should also be considered for the benchmarking analysis. Normalize the number of hours of class per week to account for different operating schedules.

4. Rank the schools using an index that condenses all the benchmarking figures into one indicator of overall performance. Each school's position in the index should be computed as the average of the ranked positions of that school under each indicator computed in step 3. Facilities should then be sorted into rank order based on the index so that a decision-maker can determine, at a glance, a specific school's performance relative to that of the other schools in the district (**Figure 2**, next page). This index provides a single metric that reflects all of the important performance indicators that will be of interest to the school district.

5. Identify the worst performers. The rank index will reveal which schools consume more energy than their counterparts within the district.

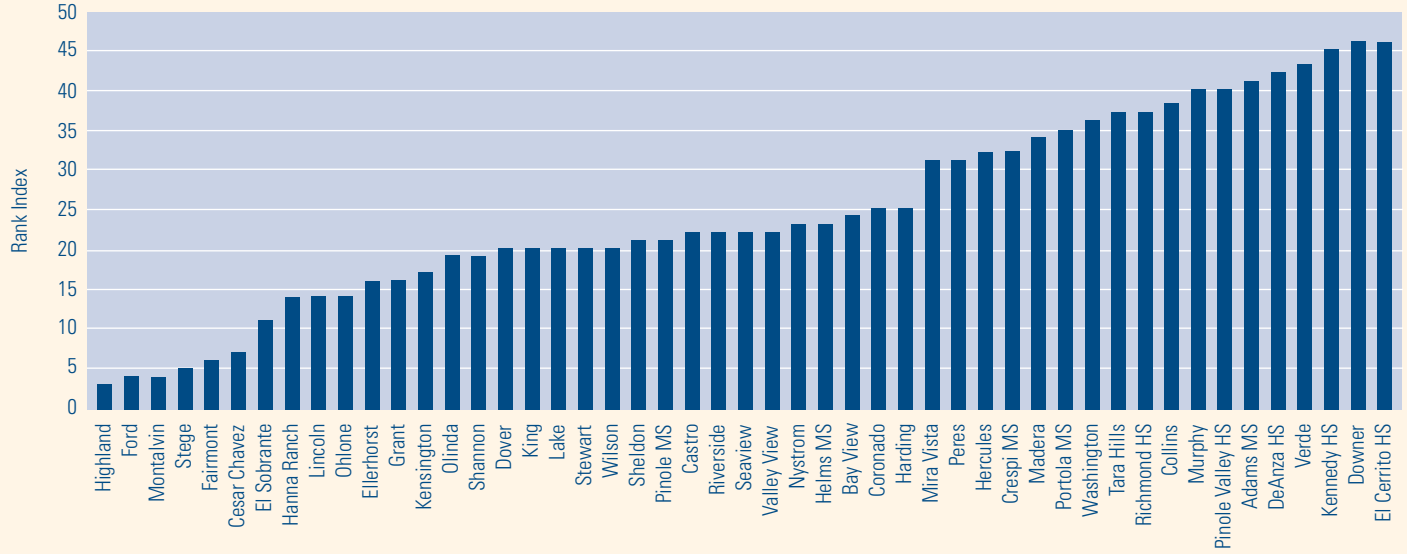
6. Develop an action plan for the highest energy users after determining which building systems might be malfunctioning in those facilities. This could be done through an energy audit or by placing more-sophisticated monitoring equipment in those schools to find out what is causing the higher energy use.

Applications

School districts generally need to monitor the energy impact of new construction, major renovations, and energy-efficiency

Figure 2: Rank index for school benchmarking

The rank index, which combines all of the benchmarking metrics into one indicator of performance, sorts the facilities in order of their overall energy performance.



retrofits. Researchers found that officials demand timely, easy-to-understand energy information and benchmarking methodology. The benchmarking method described here can be applied to any school district. The California Energy Commission is also working to extend the methodology to other types of buildings.

California Codes and Standards

California Executive Order S-20-04 establishes a priority for energy- and resource-efficient buildings. One secction of the order calls for the California Energy Commission to develop a simple building efficiency benchmarking system for all commercial buildings by July 2005. The action plan includes benchmarking at the time of sale as well as a system that can provide benchmarking ratings to tenants, buyers, and lenders to advise them in making decisions about a given facility.

What's Next

New benchmarking methodologies, benchmarking information delivery mechanisms, and more benchmarking tools are planned as part of the PIER program. The PIER program is especially focused on creating new tools to more accurately identify actions that could reduce energy use and peak demand.

Collaborators

The organizations involved in this project include Pacific Gas and Electric Co., the Massachusetts Institute of Technology, and the West Contra Costa Unified School District.

For More Information

Reports documenting this project and providing more details may be downloaded from the web at www.energy.ca.gov/pier/buildings/projects/400-99-012-1-2-2_1.html.

To view PIER Technical Briefs on other topics, visit www.esource.com/public/products/cec_form_send.asp.

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About PIER

This project was conducted by the California Energy Commission's Public Interest Energy Research (PIER) program. PIER supports public-interest energy research and development that helps improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.

Arnold Schwarzenegger, *Governor*

For more information see www.energy.ca.gov/pier

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